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**DEFENSE NUCLEAR FACILITIES  
SAFETY BOARD**

Washington, DC 20004-2901



October 29, 2015

The Honorable Frank G. Klotz  
Administrator  
National Nuclear Security Administration  
U.S. Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585-0701

Dear Administrator Klotz:

Members of the Defense Nuclear Facilities Safety Board's staff conducted a review of the conceptual design activities and safety basis development for the Electrorefining (ER) Project at the Y-12 National Security Complex. The conceptual design documents for ER have appropriately identified the structures, systems, and components (SSCs) necessary to confine and control hazardous material. We believe, however, that the National Nuclear Security Administration (NNSA) has not fully analyzed some of these SSCs to determine whether they can perform their credited safety functions. It is important to analyze these SSCs early in the preliminary design phase to assure the integration of safety into the ER design. The concerns associated with these SSCs are discussed in the enclosure to this letter.

We understand that analyses related to the Building 9998 structure, Building 9998 sprinkler system, and ER confinement approach will be conducted later in the ER design process or as a part of a future extended life program for the 9215 Complex. Therefore, pursuant to 42 U.S.C. § 2286b(d), we request that NNSA provide a schedule within 60 days for when specific analyses for these SSCs will be conducted.

Sincerely,

  
Joyce L. Connery  
Chairman

Enclosure

c: Mr. Robert Raines  
Mr. Joe Olencz

## **ENCLOSURE**

### **Summary of the Electrorefining Project and Related Concerns**

**Project Summary.** The Electrorefining (ER) Project is part of the Metal Purification Process (MPP) Project at the Y-12 National Security Complex (Y-12). The MPP Project, which includes the Direct Electrolytic Reduction, ER, and Uranium Trichloride Projects, is intended to replace the current processes at Y-12 that recover and process enriched uranium in Building 9212. This includes processing contaminated scrap and residues from a variety of production operations, as well as uranium oxides from casting operations. The MPP Project is intended to reduce the hazards associated with enriched uranium metal recovery as it is currently performed. In addition, the deployment of the MPP Project in an existing facility is a critical component of the National Nuclear Security Administration's (NNSA) strategy to maintain a metal purification and production capability once the capabilities currently housed in Building 9212 have been shut down. NNSA approved the Critical Decision 1/3A milestone for the ER Project on September 3, 2015.

The Y-12 contractor, Consolidated Nuclear Security, LLC (CNS), determined that the MPP Project represented a major modification to Building 9998 under Title 10 of the Code of Federal Regulations Part 830, *Nuclear Safety Management*. CNS developed a Safety Design Strategy (SDS), Preliminary Accident Analysis (PAA), Preliminary Fire Hazards Analysis (PFHA), and Criticality Safety Process Study (CSPS) as part of the conceptual design. The ER PAA states that the unmitigated consequences for all events involving ER (e.g., seismic events, large fire, or criticality) are "minor" or "low," which correlate to facility worker impacts with no significant impacts on collocated workers or the public.

**Safety Concerns and Project Responses.** Members of the Defense Nuclear Facilities Safety Board's (Board) staff reviewed the SDS, PAA, PFHA, and CSPS. Staff members identified several instances where the ER Project relied on new and existing structures, systems, and components (SSCs) that have not yet been shown to adequately meet their credited safety functions. Specifically, the review team noted concerns associated with the Building 9998 structure, ER confinement approach, Building 9998 sprinkler system, and the use of combustible glovebox windows.

DOE Standard 1189, *Integration of Safety into the Design Process*, states:

Important safety functions, such as facility building confinement, confinement ventilation approach and systems, fire protection strategies and systems, security requirements, life safety considerations, emergency power systems, and associated seismic design bases are addressed during conceptual design.

Therefore, it is important to analyze these SSCs early in the preliminary design phase to ensure that they can meet their credited safety functions to assure the early integration of safety into the ER design. The review team discussed the concerns associated with these SSCs with ER Project personnel and plans to follow up on these concerns during preliminary design.

*Building 9998 Structure*—The ER Project will be housed in Building 9998, which is part of the 9215 Complex. A Board letter to the NNSA Production Office Manager, dated February 4, 2015, documented structural deficiencies in the 9215 Complex that limit its seismic performance. These deficiencies give the facility a higher probability of collapse than the failure probability of the ER SSCs contained inside. Therefore, the ER Project cannot ensure that the new ER SSCs can meet the designated Seismic Design Category (SDC)-2 performance for new SSCs.

In addition, Section 9.1, *NPH Design and Evaluation of Existing Facilities for Major Modifications*, of Department of Energy (DOE) Standard 1020-2012, *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities*, states:

For major modifications of existing facilities, the design of SSCs shall be based on the methods and criteria given in this standard for new facilities with the following caveat. On a case-by-case basis, analyses may be performed to evaluate the need to upgrade existing SSCs (including interfacing SSCs) in accordance with these criteria. Sections 9.3 and 9.4 provide guidance on the conduct of such analyses. The analyses shall be submitted to the DOE for approval, in the form of a report or a section in the project's Safety Design Strategy (see DOE-STD-1189), with recommendations and justification for the recommendations.

Currently, any analyses of the 9215 Complex structure, including Building 9998, would be conducted separately from the ER project as a part of the planned facility-wide extended life program. The timeline for the structural analyses for Building 9998 has not yet been determined. DOE Standard 1020 indicates that the ER Project needs to either upgrade the existing structure to meet the criteria given for new facilities in DOE Standard 1020 or perform an analysis specific to the ER Project that shows whether or not such upgrades are needed. Per DOE Standard 1020, any such analysis would need to be approved by NNSA.

*Confinement Approach*—DOE Order 420.1C, *Facility Safety*, requires that a facility maintain confinement of radioactive materials during normal operations and during and following accidents. The ER Project is pursuing an alternate confinement approach that relies on SDC-2 equipment (e.g., ER glovebox) as the primary confinement boundary and does not credit an active confinement ventilation system or the existing facility infrastructure. In accordance with DOE Order 420.1C, alternate confinement approaches require a technical evaluation that demonstrates very high assurance of the confinement of radioactive materials. NNSA has identified performance gaps in the ability of the Building 9998 structure and ventilation system to provide an adequate confinement function as documented in Board Recommendation 2004-2 Implementation Plan Deliverable 8.6.5, transmitted to the Board on February 10, 2011. The ER SDS noted that these gaps still exist. In addition, the ER confinement includes a positive pressure glovebox. Therefore, accidents causing the glovebox boundary to fail (e.g., seismic events causing building collapse on the glovebox or fire events that impact the glovebox gloves or windows) could result in a loss of confinement of radioactive material. The ER project plans to conduct the required technical evaluation later in the design process.

*Fire Protection*—The ER PFHA identifies the existing automatic sprinkler system in Building 9998 as a pipe-schedule system designed to the 1969 edition of National Fire Protection Association (NFPA) 13, *Standard for the Installation of Sprinkler Systems*. CNS personnel stated that decisions on upgrading the sprinkler system to comply with the current standard (issued in 2013) will be made as part of the planned facility-wide extended life program, and that the system would likely be used “as-is” with minimal modifications. However, the PFHA did not establish adequate performance of the existing sprinkler system for the modified use of the space. Analysis is needed to demonstrate whether the sprinkler system can perform its credited safety function for the ER Project.

In addition, NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*, and American Glovebox Society AGS-G010, *Standard of Practice for Glovebox Fire Protection* (referenced by DOE Standard 1066), state that glovebox windows shall be constructed of noncombustible materials. However, the ER Project is planning to use combustible Lexan® windows. The ER Project justified this decision by citing Equivalency Request Y/FPEE-007, which permits the use of Lexan®. The NNSA Y-12 Site Office approved this Equivalency Request on July 13, 2007. However, the Equivalency Request does not include a technical evaluation to demonstrate that a combustible, break-resistant material (e.g., Lexan®) provides performance equivalent to a noncombustible, less break-resistant material (e.g., laminated safety glass). Such an evaluation is needed to determine whether the glovebox can perform its credited safety functions. The results of this evaluation could extend beyond the ER Project because the Equivalency Request has been used at other facilities throughout the Y-12 site.